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MARCH 16, 1889.

THE AMERICAN ARCHITECT AND BUILDING NEWS

VOL. XXV. REGULAR EDITION NO. 690.

ARCHITECTVRE

ENGINEERING

DECORATION

CONSTRVCTION

TICKNOR & COMPANY

BOSTON MASS.

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House of Dr. W. B. Parker, Marlborough St., Boston, Mass.
(Gelatine Print issued only with Imperial Edition.)
The Luray Inn, Luray, Va.
Interior of St. Mark's, Venice.
The Mission Church, Santa Barbara, Cal.
An Old California House.
Court-yard of an Adobe House at Los Angeles, Cal.

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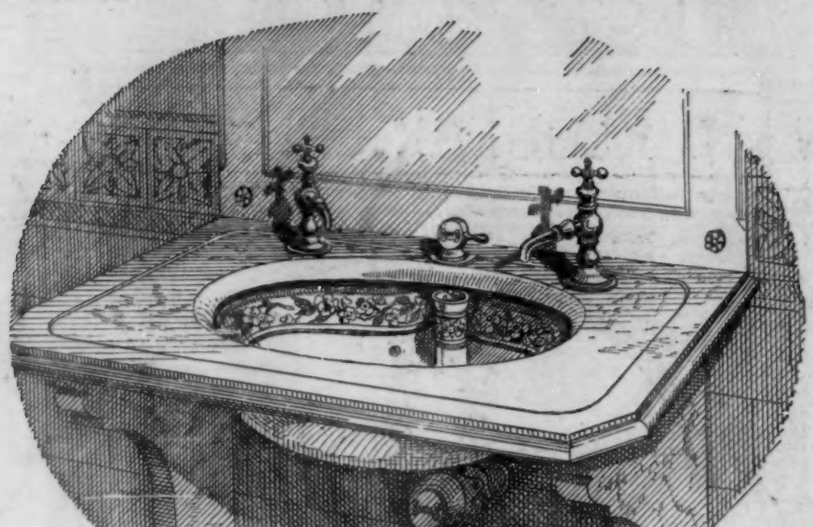

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Entered at the Post-Office at Boston as second-class matter.

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ACCORDING to the New York *Sun*, the competition for the New York Episcopal Cathedral will be decided before this paper is laid before our readers. We do not feel always quite certain of the accuracy of the *Sun's* information on such subjects, and the account which it gives of the way in which the best designs are to be selected has a rather improbable air, but, as the contest really seems to have closed for the present, we will permit ourselves to make a few remarks upon some of the circumstances that have attended it. In the first place, the "literary bureau" has, to our mind, been altogether too prominent ever since the designs were sent in. Mr. Russell Sturgis's well-meant and interesting description of his idea of a great cathedral, which was published before the drawings were sent in, and thus escapes any imputation of having been circulated *pendente lite*, seems to have served as the text, or rather, as the excuse, for a number of others, which, however innocent the intentions of their authors may have been, are certainly open to that reproach. The variety of these lucubrations seems to have been as admirable as the eloquence with which the opinions contained in them were advocated. One author advised the Trustees, in the most earnest manner, that the "Gothic style was dead, never to be revived," an announcement which will, we imagine, be news to a good many architects, as well as to the Trustees. Another thought that the Byzantine style was the only one which had any claim to consideration for an important American building. In fact, several people had this idea about the Byzantine style, but their notions varied as to what the style consisted in. One writer was sure that, to be architecturally valuable, the Cathedral should be arranged like a Greek church, forming a cross of four equal arms on plan. This disposition, he thought, was not only more truly Byzantine than any other, but it afforded peculiar facilities for gathering a large congregation about a preacher placed in the centre. It did not escape the penetration of this author that a good many Episcopalians do not think that the only object of going to church is to hear preaching, but he contrived to head off unfavorable criticism from such persons by explaining that while a few "Ritualists" might not like a church devoted wholly to congregational purposes, they formed only a small and insignificant portion of the Episcopal communion, and, besides, they might have processions in the side-chapels if they wanted them. Another essayist, while he thought, like the others, that the Byzantine was the only style admissible, considered that even this would not make the church what it should be unless the design comprised a tower four hundred feet high. A fifth believed that nothing but a round-arched design should be thought of, but it might be either Byzantine or Renaissance, and there were advantages in the Renaissance; while a sixth was sure that the Renaissance, of which he mentioned St. Peter's, at Rome, as a conspicuous example, was the only suitable style. It would take too long to mention all the different methods of treatment which were extravagantly lauded in one newspaper or another, and it is hardly necessary to say that, to architects, all the arguments and considerations brought forward were pure rubbish. If they had been of any value, the proper time to advance them would have been six months ago, when the competitors were getting their ideas into shape, and a suggestion that was good for anything would have been welcome; but, coming after all the designs had been sent in, and nothing remained but to judge them, some of them, at least, had an air of attempting surreptitiously to influence the decision, which was very disagreeable. In a shabby, second-rate contest, like that for the Boston State-House, where the quills of the penny-a-liners reinforced to an amazing degree the pencils of the draughtsmen, such things are, perhaps, to be expected; but even in Boston the services of the newspapers were not called in until after the experts had rendered their judgment, and the affair had gone for decision into the hands of the members of the Legislature, who were presumed to be vulnerable to arguments at which an expert would only laugh.

A NEW and important question has come up among the trades-unions. For some time the annual transfer of skilled mechanics from this country to England, and *vice versâ*, has been increasing, until it has come to threaten seriously the power of the Union leaders. Some time ago, when the walking-delegates of certain trades saw fit to keep their subjects idle and poor, while they drew good salaries for talking nonsense, or worse, a considerable number of the victims of this arrangement quietly slipped across the water, and went to work at their trades where they need not fear being denounced to their Union officers and deprived of their living. The result was so encouraging that they repeated the experiment, taking others with them, and the Union discipline has, in consequence, now lost its terrors for many of the more enterprising working members. On the other hand, members of foreign trades-unions about the same time discovered the advantage of a reciprocal arrangement of the kind, and it is becoming a very common practice for English, Irish and Scotch stone-cutters, masons, and carpenters to come over to New York in the spring, spend the summer in working at their trades, without asking leave of any one, and go back in the autumn, with their pockets full of American money, to work in England through the winter, when there would be no employment for them here. A reporter of the Philadelphia *Call* recently made some inquiries about the matter in that city, and found that nearly all the trades were more or less affected by the competition of the foreign workmen. The Union officers were unanimous in the opinion that the "evil" was increasing, and that "heroic remedies" were necessary. What their "heroic remedy" will consist in remains to be seen, but some indication may be found in the resolution which was passed at the Convention of the National Association of Stone-cutters, held the other day, which provided that members "should not visit Europe oftener than once in five years." If such a rule should be enforced, the American workingmen would lose the last prospect of escape from the tyranny of delegates which now remains open to them. This, from the Union point-of-view, would be a great gain, but there seemed to be an idea in the Convention that, if the resolution was passed, the foreign unions would take similar action, and workingmen on both sides of the water would be held captive, for fear that they might interfere with each others' monopoly.

THE *British Architect* publishes a short article on stone-carving, which we hope may be the introduction to a more extended discussion of this very important subject. The writer of the article had, it seems, met a man who had once been a stone-carver, but who had abandoned his profession on account of the difficulties and annoyances connected with it, for which he considered the architects principally at fault. According to him, there are plenty of skilful and artistic carvers to be had, but they get such poor pay, and are treated with so little deference, that they have become discouraged, and either leave the business, or, we suppose, console themselves by turning out the stupid, spiritless work that we usually see. How different things would be if architects did their duty, we may infer from this gentleman's description of the good old times when stone-carvers and architects alike were virtuous and happy. This blissful period coincided with the construction of the Saint Pancras Railway-station in London, when the carvers got fifteen shillings a foot for their labor, and often "drove up in hansoms to their work, and worked only three or four days in the week." Then, also, the carvers did not have to use their brains (if they possessed any, which we should say was doubtful in the case of men who went to their work in carriages),

but did all their carving from models, previously prepared by some one else. Unfortunately, through the machinations of architects, the price of carving is now reduced to twelve shillings a foot, and the men who do it are compelled, like the architects themselves, to work six days in the week in order to get a living. This is the reason, we are told, why the work is done so badly. If architects want good carving on their buildings, the way to get it is to make a contract directly with a carver, give him plenty of money for his work, and plenty of time to do it in, construct a warm and comfortable enclosure for him, and treat him with great deference and politeness. We hope architects will lay this advice to heart. While it may not be perfectly obvious why the work of a man who devotes three days in the week to his business, and the other four to getting drunk, should be so much superior to that of people who keep steadily at their task, it is plain that men work better who have a reasonable amount of comfort about them, and if the carvers are too lazy to get this for themselves, they might as well expect the architect as any one else to provide it for them. As every service on one side, however, implies a corresponding obligation on the other, we hope it is not too much to expect one thing from the persons for whom the architect is to do so much; that is, that they should know something about their business. So far as architects are concerned, there would be no difficulty in having all necessary facilities provided, and a proper price paid, for anything like such carving as they wish to see on their buildings; but in the great majority of cases English and American architectural carving is simply a disfigurement to the building to which it is applied, and the architect's principal anxiety is to get it done as quickly, and with as little elaboration to its ugliness, as possible. Even if it is good, the more quickly it is done the better, and the elegant and well-paid leisure which seems to be so dear to the carver, signifies to the architect the ruin of the effectiveness of his carving by sand-papering and smoothing. This is the real reason why architects who care about the carving on their buildings always want it done rapidly. The examples that they have in mind, the mediæval and early Renaissance details, were done very quickly and cheaply. Perhaps the most beautiful specimens of architectural carving in existence, the capitals at the Castle of Chambord, are known to have cost twenty cents apiece, and it is hard to give up the hope that by limiting the time that a good carver is allowed to devote to the work, he may be forced into the brilliant and effective style of the early sculpture. That the hope is a delusive one most experienced architects know. A few carvers can work effectively with a toothed-chisel and a drill, but they are very few, and even their skill is almost always limited to a set of stock forms, outside of which they are helpless. At present, in this country, what little capacity for carved stone detail once existed seems to be disappearing, under the influence of the gigantic acanthus-leaves which, by the authority of Révoil, apparently, do duty for Romanesque detail. To produce such things there is no need of taste, power of design or knowledge of nature, and those aids to architectural sculpture will probably remain dormant until some change in the fashion shall bring them again into activity. When this happens, we hope the change may be a complete one. Before our architecture can take its place as an art worthy of a great people, it must include beautiful and original sculptured detail. This it has never had, and never will have, until a school of architectural sculpture shall be founded, in which shall be taught, not the art of keeping up a genteel appearance, or of dawdling four days out of the seven, but that of composing and representing natural forms, an art in which no one has yet reached perfection.

A DESCRIPTION of the arrangements for producing and distributing force at the Paris Exhibition is given in *Le Génie Civil*, which will have an interest for those who may have to do with such installations on a large scale. The motive power is to be derived from eleven boilers, placed in the space behind the Machinery Hall. Three of these are English, one Belgian, and the rest French, our own country not being represented in this department. A contract has been made with the exhibitors of these boilers for the supply of one hundred and twenty thousand pounds of steam per hour, to be used not only in the various engines, large and small, which are to be shown in motion, but for other purposes where steam is required. The main engines, which propel the great lines of counter-shafts from which all the small machines not having motive force in themselves take their power, are thirty-two in number. Two of these are American, one from Sweet, of Syracuse, and one, of a hundred horse-power, from Brown, of Fitchburgh, and these will provide the motive power for the American part of the exhibit of machinery. We venture to say that our countrymen will have no reason to be ashamed of the way in which the service is rendered; but they will not be entirely dependent on these, an arrangement having been made by which each section of the great counter-shafts, although ordinarily independent of the rest, can be coupled by means of a sleeve to the neighboring section on either side, so that the movement is kept up, even though the action of its own propelling-engine is suspended. Power enough is kept in reserve, also, for such a contingency. A contract has been made with the exhibitors of the engines for the regular supply of twenty-six hundred horse-power at the counter-shafts, but the engines are amply able to supply double that quantity if required, and a price has been agreed upon at which extra power may be had from any engine. As steam is supplied to the engines, the cost of the power is, of course, only that of oil and attendance, with a certain amount for wear and tear, and interest on the value of the plant. This seems to have been closely calculated by the owners of the engines, and a uniform contract has been made with all of them, by which they agree to furnish the twenty-six hundred horse-power fixed as the normal requirement, dividing the amount among themselves, in proportion to the capacity of their engines, at eight dollars per horse-power for the one hundred and eighty days that the exhibition is intended to last, and for seven hours each day. If extra power is required during the regular exhibition hours, this is to be supplied at six-tenths of a mill per horse-power per hour, and, if the duration of the exhibition should be prolonged, the price of power is to be one mill per horse-power per hour. The counter-shafts are arranged in four lines through the building, their total length being a little over a mile. As with everything else, a contract has been made for the erection and use of these shafts, including supervision and oiling, at something less than thirteen dollars for the intended duration of the exhibition for each metre in length of shaft. If more than seven hours' service per day is required, a small sum is to be paid extra for surveillance and oiling, and for every day of prolongation of the exhibition the price per metre per day of seven hours is to be eight cents. To give suitable facilities for supplying the boilers with water and the engines with steam, and for carrying off the condensed water from the exhausts, if that should be required, a subway has been built, in which run three pipes. One of these, two feet in diameter, carries cold water to the boilers from the Seine; another, of the same diameter, serves as principal steam-main, and the third conveys the condensed water. A similar subway, parallel with the first, contains a group of smaller pipes, and branches extend to the various engines, the whole length of subway being about a mile.

THE foreign papers have a good deal to say about Signor Brentano, the winner of the first prize in the competition for the completion of the Cathedral of Milan, and the author of the design adopted for execution. He is, as it seems, a very young man, being only twenty-four or five years old, and this is naturally his first important work. A few years ago he was a student at the Higher Technical School at Milan, being maintained there, if we are not mistaken, by the town of Siena, his native place. While at the school he was under the instruction of Professor Beltrami, also one of the favored competitors for the Cathedral, and seems to have imbibed his master's ideas. On leaving the school, three years ago, he competed for a travelling-scholarship offered by the town of Siena and won it, and the Cathedral competition being just at that time announced, he resolved to devote his tour to the study of cathedral architecture, with a view to entering the competition. The success of his efforts has made him famous throughout the civilized world, and nothing remains but the execution of the work, which we hope will not be long delayed, to place him among the foremost architects of the century. Singularly enough, his design and that of Professor Beltrami were very much alike, both of them having devoted themselves to the production of an elaborate façade, following the outline of the building behind it, without any addition of towers or screen-work. Professor Beltrami, indeed, placed a detached campanile by the side of his design, but this was rather an independent suggestion than a part of the design.

BUILDERS' HARDWARE.[1]—XXI.

FRONT-DOOR LOCKS.

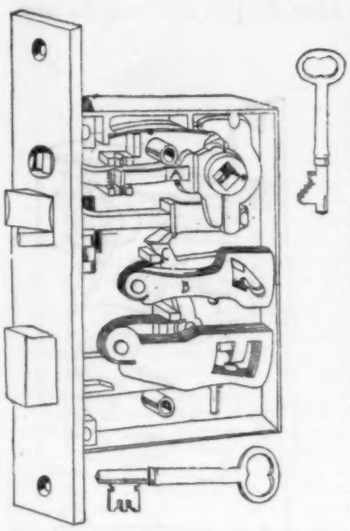


Fig. 317. Front-Door Lock. P. & F. Corbin.

THE greatest amount of care and ingenuity has been expended upon the locks which are used for the front-doors of dwelling-houses, and the largest degree of complication is usually found in these goods. They afford, generally speaking, a greater security against picking than do the locks which are employed for inside-doors. The conditions of an outside-door lock are that it shall have two sets of mechanisms operated by keys, to move either bolt or latch at will, and shall have the knob-spindle so arranged that the latch can be moved by turning either knob, and that the outside knob can be made immovable, while the inner one is free to move. Front-doors are usually two inches or more thick, and the lock can consequently be made quite thick, so as to permit of multiplication of the levers, and a stronger mechanism than for inside-doors. A front-door lock should always have an anti-friction strike.

Figure 317 shows a form of front-door lock manufactured by P. & F. Corbin. This is fitted with an anti-friction strike, and has four levers each for the lock and the night-latch. The follow is in two pieces. When the small catch on the face-plate over the latch is shoved to one side, the lever, *A*, is moved so as to fit in a slot on the side of the outside follow, as shown by the figure, thus holding the follow, and with it the outside-knob and spindle, so they cannot be moved. The night-key operates by first lifting the levers *B*, and by moving the lever, *C*, which carries back with it the latch-bolt. Figure 318 is a form of rebated-door lock by the same manufacturers. It is inserted here merely to show the manner in which mortise-locks are fitted to a rebated-door.

Figure 319 illustrates a front-door lock manufactured by Russell & Erwin. The levers on the locking-bolt, *A*, are attached to the bolt, and move with it, not being particularly proof against picking, however. In operating the night-latch, the levers *B* are pushed to one side until the gatings are on a line to permit the post, *C*, to pass, the post forming part of a bent lever, the end of which shows at *D*, which portion acts directly against *E*, and so draws back the latch. In order to secure the outside knob, the catch on the face-plate is pushed up, throwing the slots on the lever *F*, *F* over a shoulder on the outside-follow. Figure 320 is another front-door lock by the same manufacturers.

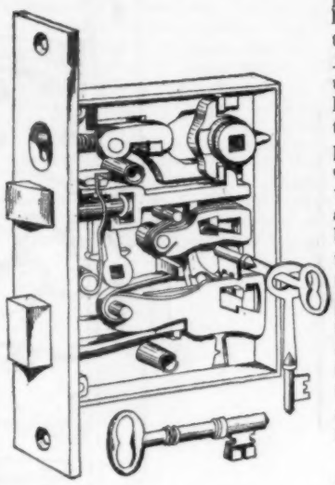


Fig. 319. Front-Door Lock. Russell & Erwin.

Figure 321 is a very excellent lock manufactured by J. B. Shannon & Sons, so arranged that the knob comes between the night-latch and the lock-bolt. It will be noticed that the levers and the posts are notched in the same manner as was explained for some of the dead-locks. The latch is moved by means of a lever, *A*, underneath the upper set of levers, *A* being attached to the latch-bolt. This is a very secure lock.

Figure 322 shows a variety of the "Niles" front-door lock, which is quite simple in its arrangement. The latch is worked by the lever *A*.

A very simple but efficient lock is shown by Figure 323. The latch-key works through a curtain, *A*, raising the levers until the post, *B*, and with it the plate *C* and the latch can be drawn back. This lock is made in the "New York" style, with a single follow, intended to receive the spindle of the inside-knob.

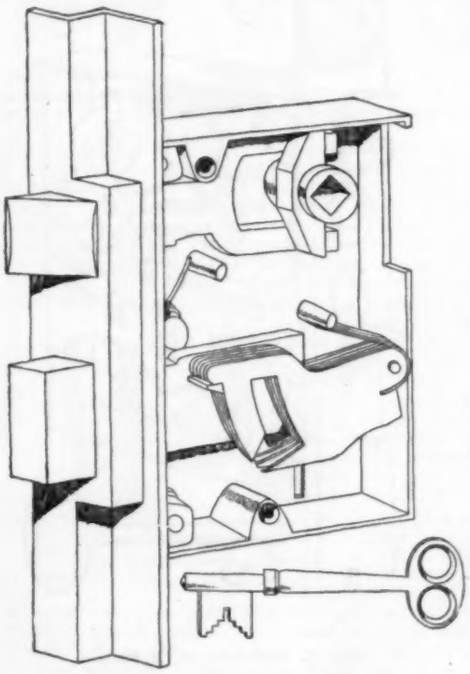


Fig. 318. Mortise Knob-Lock. P. & F. Corbin.

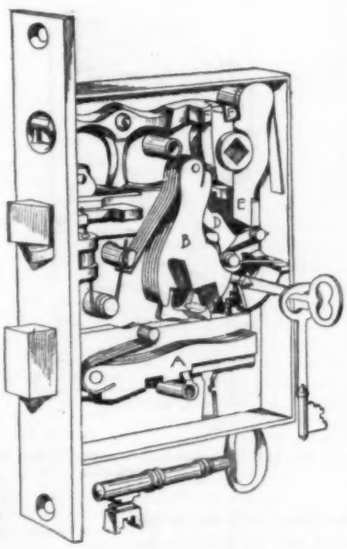


Fig. 320. Front-Door Lock. Russell & Erwin.

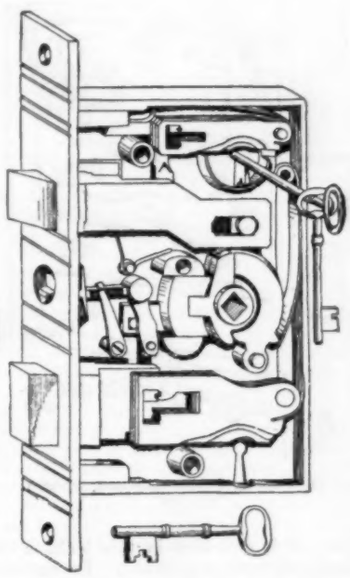


Fig. 321. Front-Door Lock. J. B. Shannon & Sons.

Figures 324 and 325 illustrate two styles of front-door locks by the Hopkins & Dickinson Manufacturing Company. The former is rather a light lock, the latter especially strong and heavy, and fitted with five levers to both latch and lock.

Figure 326 shows one of the best of the front-door locks,

[1] Continued from page 112, No. 689.

the "Standard," by the Yale & Towne Manufacturing Company. There are three steel levers for both the latch and the lock. The night-key pushes the levers *B* to one side and moves the bent piece *A*, which forces back the latch-bolt. The tongue, *C*, which locks the outside-knob, is pushed in or out by the buttons on the face-plate. It is not intended to use this lock with a swivel-spindle, but when the knob is locked by the tongue *C*, a spindle and cam at *D* serve to throw back the latch from the inside of the door. The arrangement of the levers *B* is defective in this lock, in that they will not work should the springs give out. Levers which act by gravity, as well as with springs, would seem to be more suitable.

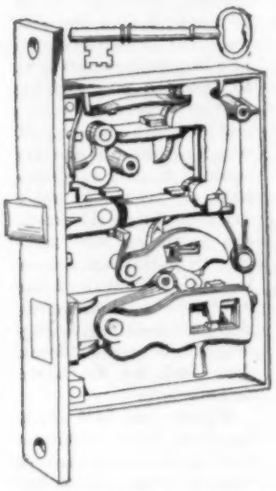


Fig. 322. Niles's Front-Door Lock. Chicago Hardware Co.

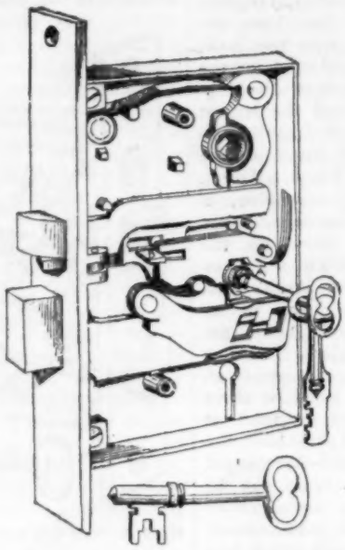


Fig. 323. Front-Door Lock. A. G. Newman.

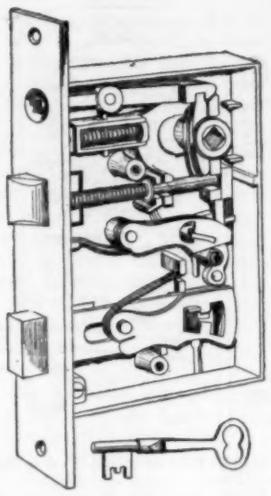


Fig. 324. Front-Door Lock.—Hopkins & Dickinson Mfg. Co.

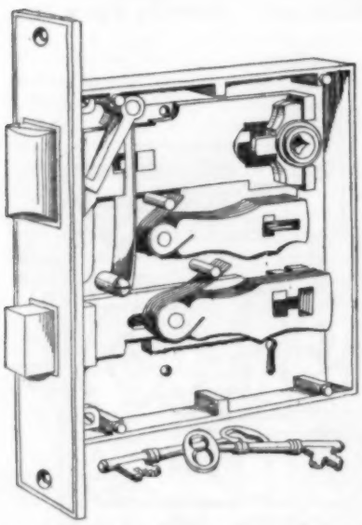


Fig. 325. Front-Door Lock. Hopkins & Dickinson Mfg. Co.

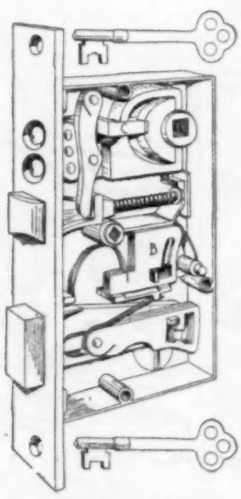


Fig. 326. Yale Standard Front-Door Lock. Yale & Towne Mfg. Co.

The lock represented by Figure 327, is one of "Robinson's" best make, being sold, with the corresponding vestibule lock, at $14 per set. It is a hand-made lock, all the mechanism being of brass. In the examples previously considered, there have been two sets of levers to each lock. In this case, however, there is but one, the holes for the night-latch and the dead-lock key being side by side. The shape of the levers will explain the arrangements, two sets of gatings and rackings being cut on each. The dead-lock key acts against the edges at *A*. *B* is the post on the bolt-tail, which passes through the gatings in the ordinary manner. The night-key acts against the edges *C*. The post *D* is attached to a sliding-plate, working between the levers and the dead-bolt tail. The lever *E* is pivoted to this plate and also to the lock-case. When the levers are raised so as to allow the post *D* to enter the ratchings, the plate and the lever *E* are drawn back together at the same time as the latch. The follow is made double, to permit of swivel-spindles, and the outside is locked by the arm *F*.

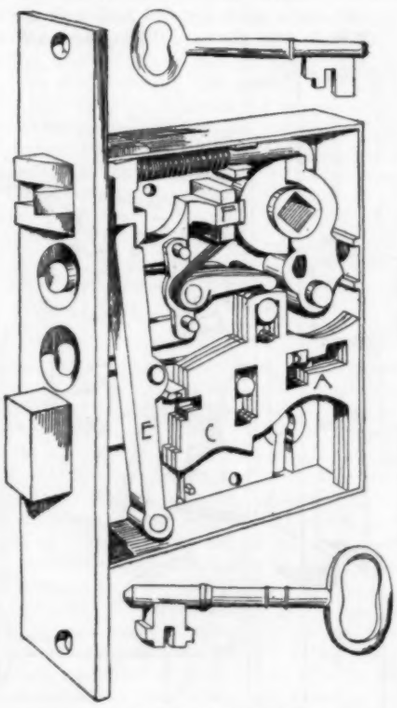


Fig. 327. Front Door-Lock. E. Robinson.

The latch has a very easy spring, the follows being stiffened by a spring beneath *G*.

Hall manufactures a front-door lock almost exactly like Figure 327, but with his peculiar anti-friction strike.

(To be continued.)

ARCHITECTURAL SHADES AND SHADOWS.[1] — II.

CHAPTER II. — GEOMETRICAL CONSIDERATIONS.

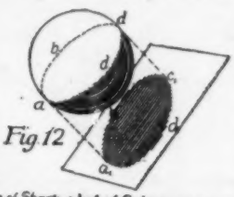


Fig. 12

Line of Shade abcd of Sphere is a great circle: its Shadow a,b,c,d, on a plane is a circle or ellipse

16. We have already observed that that part of the surface of any opaque body which receives light from the sun at any one time is said to be *in light;* the unlighted part is said to be *in shade*, and the mathematical line separating the two is called the *line of shade*. That portion of space lying behind the object, and from which the rays which light the object are excluded, is called its *shadow in space* or *invisible shadow*. Whenever this or any portion of it is crossed by an opaque surface turned towards the sun, the light is excluded from so much of this surface as intersects the shadow, while the rest remains illuminated. The darkened portion of the surface is called the *visible* or *cast shadow* of the object, and its outline the *line of shadow*.[2] Fog, smoke, or dust will render these invisible shadows visible by filling the air with countless microscopic particles of vapor or solid matter, a part of which remain in the darkness of the shadow in space while the rest are in light.

17. The form of a cast shadow is evidently that produced by the intersection of the surface on which it falls (sometimes called the *surface of incidence*) with the invisible shadow. The latter is, in the case of a sphere, for example, a solid circular cylinder of indefinite length. If the surface of incidence is a plane, its intersection with this cylinder must be bounded by a circle or ellipse, which is therefore always the form of the shadow of a sphere upon a plane (Figure 12).

18. Now if we imagine the body that casts the shadow to be infinitely small — in other words a point — its cylinder of invisible shadow becomes a mere line, and its cast shadow is reduced to a point. The shadow-in-space of a line is a *surface* whose elements are the *invisible* shadows of all the points composing the line; its cast shadow is a *line* composed of the *cast* shadows of all these *points*. Returning now to our illuminated sphere, it is easy to perceive that every point of its line of shade casts a shadow which is a point of the outline of shadow of the sphere. This outline of shadow depends therefore wholly upon the line of shade for its form upon any given surface of incidence, and the same is true of the shadow-in-space whose surface is composed of the invisible shadows of all the points of the same line of shade. This is very important to note, for it reduces the whole problem of sciography to the finding of the shadows of lines of shade only. No matter how irregular or complicated the surface of an object may be, its form need concern us no further than is necessary for ascertaining its line of shade. When the shadow of this line is found, the problem is solved. Thus the sphere shown in Figure 12, may be disfigured out of all recognition, as in Figure 13, yet if the line of shade is not touched but remains still a circle, the cast shadow will remain unchanged, a circle or ellipse. The problems of sciography are greatly simplified by bearing constantly in mind that there is no question of the shadows of surfaces or solids, but only of the shadows of lines. Even the problem of finding the shadow of a point is solved by finding the shadows of any two lines passing through it.

Fig. 13

Shadow always cast by Line of Shade, hence unchanged by disfiguring the object if Line of Shade is intact.

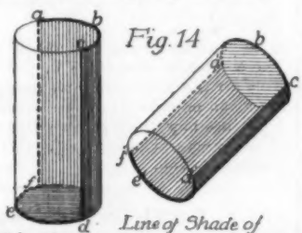


Fig. 14

Line of Shade of Cylinder composed of two half circles abc, def, and two right lines, af, cd.

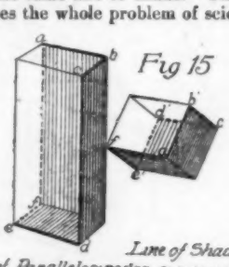


Fig. 15

Line of Shade of Parallelopipedon composed of six right lines ab, bc, cd, de, ef, fa.

20. The line of shade of any solid or surface is a line passing through all the points at which the rays of light are tangent to the surface. To find and draw these points and this line, is a problem of pure descriptive geometry which will be fully discussed later. But in the case of many solids composed of geometric elements it can be at once determined, by observation of the nature of these geometric elements and their relation to the light. Thus the line of shade of a sphere in any position is a great circle perpendicular to the rays of light. The line of shade of a cylinder is composed of the two opposite half-circumferences of its two bases, and the two rectilinear elements of the cylinder joining them (Figure 14). So of a parallelopipedon, the line of shade is evidently, in most positions, composed of six lines, viz.; two adjacent edges of each base, and the two parallel edges connecting them (Fig. 15). And in case of any finite solid, the line of shade must be a continuous and complete figure.

21. The case of plane figures offers some peculiarities worth noticing. We shall for the sake of convenience and analogy treat them as having two sides or faces, and edges of infinitesimal thickness, or in other words, as very thin discs.

a. When such a disc is normal to the direction of the light, one face is light, the other dark; the whole edge or perimeter becomes its line of shade, having a cylindrical[3] surface for its invisible shadow and a figure for its cast shadow (Figure 16, *A*). When it is inclined to the rays of light, a part of its edge is light and the other dark, and the short elements separating these two portions, form part of the line of shade, their shadows being those of straight lines connecting the shadows of the two opposite half-perimeters which complete the line of shade (*id.*, *B*). But in the true plane figure these become mere points, important only as the rays passing through them mark extreme points of the cast shadow.

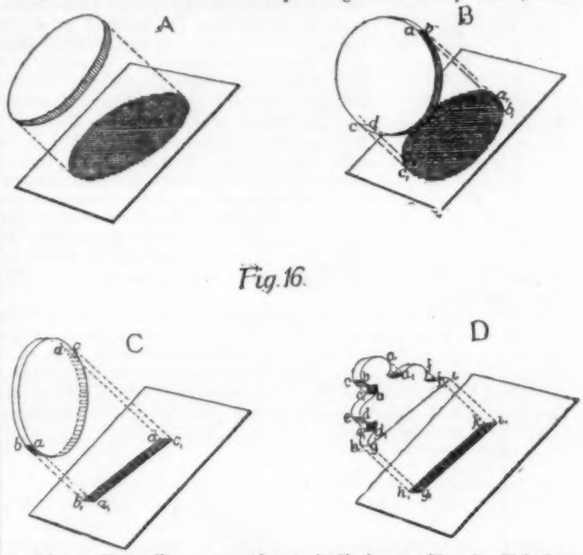


Fig. 16.

A. Disc or Plane Figure normal to Light.
B. The same, oblique to Light.
C. The same in the Plane of the Light: its Shadow on a Plane is a Right Line.
D. Plane Figure casting Shadows on its own Edge: a,b,c,d,e,f, are Shadows of $abcdef$.

Note: — When disc becomes a plane figure, the short elements ab, cd, on its edge (B) with their shadows a,b, c,d, lose their significance unless the figure is in the plane of light (C) when these shadows mark extreme points of the whole shadow.

b. When such a disc is in a plane parallel to the direction of the light (*i. e.*, a plane one of whose elements is parallel to the rays of light) the only light it receives is on its edge, part of which is in light and part in shade, separated from each other both by the elements *e e* of the edge where the rays are tangent to it, and by the two faces of the disc, which are in shearing light, and form in reality a part of the "line" of shade (*id. C*). In a real plane figure we have a curious anomaly; these two faces coalesce; the lighted edge, like the shaded edge, becomes a mathematical line, and the short elements that divide them are mere points; hence *the whole figure is its own line of shade:* the invisible shadow is a plane coinciding with that of the figure itself, and its cast shadow a line or figure lying in that plane; a right line, indeed, where the surface of incidence is a plane. The short elements *e*, *e*, that divide the light from the dark edge are significant points, their shadows being the extremities of the shadow of the figure.

c. When the figure is irregular, these points of tangency may be numerous, with shadows sometimes falling upon the edge of the figure itself, and sometimes outside of it (*id, D*). All these considerations are extremely important, as they form the foundation of the "Method of Slicing" to be described in a future chapter, by which the shade and shadow of any geometrical solid may be found.

22. The following maxims resume the preceding considerations:

VII. The invisible shadow of a point is a line, and its cast shadow a point.

VIII. *a.* The invisible shadow of a line or figure is a surface, and its cast shadow a line or figure.

b. The invisible shadow of a right line is a plane, and its cast

[1] By A. D. F. Hamlin, Instructor in Architecture in the School of Mines, Columbia College. Continued from page 90, No. 687.

[2] Lunar eclipses are caused by the moon's entering the invisible shadow of the earth, so that the illuminated side of the moon is partly or wholly covered by the earth's visible shadow. They can only be witnessed by persons on the side of the earth that is in *shade*: *i. e.*, at night.

[3] A cylindrical surface in geometry is a surface generated by the movement parallel to itself of a right line, not necessarily in a circle, but along a path or directrix which may be any curve. The circular cylinder is only a special form of cylindrical surface.

shadow a right line when cast upon a plane. In all other cases it is a plane figure, lying in the plane determined by the line itself and the rays passing through it; that is, in the plane of invisible shadow.

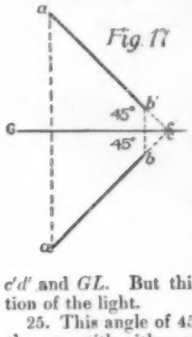
IX. *a.* The invisible shadow of a plane figure is a surface, cylindrical or prismoidal, and its cast shadow a figure, except when the figure lies in a plane parallel to the light.

b. In this case its invisible shadow is a plane, coinciding with that of the figure. Its cast shadow is a figure lying in this same plane, and, when cast upon a plane, a right line.

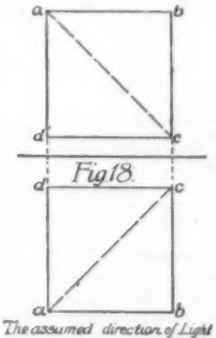
X. The shadow of a solid is the shadow of its line of shade.

23. We are now prepared to take up those considerations especially relating to architectural shades and shadows. Attention has already been called to the precise and conventional treatment in architectural drawings of the phenomena of intensity of light, shade and shadow, as well as of those relating to the direction of the light (4). The former have been treated with some fulness; the direction of the luminous rays remains to be considered.[1]

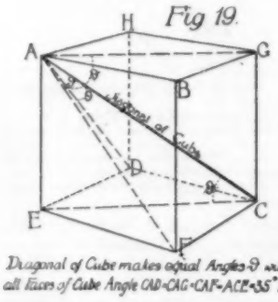
24. In accordance with universal practice, the direction of the light in architectural plans, elevations, and sections is assumed to be that of a line inclined downward to the right and towards the picture at such an angle that both its projections are inclined at 45° to the ground-line (*ac*, *a'c'*, Figure 17). This is the direction of one of the diagonals of a cube whose faces are respectively parallel and perpendicular to the planes of projection, and which we shall hereafter frequently refer to as a "principal cube." For in the cube *abcd*, *a'b'c'd'* (Figure 18), which is so situated, the projections of the diagonal from the left-hand upper near corner *aa'* to the lower right-hand farther corner *cc'* are diagonals of the squares which represent the cube, and, therefore, inclined at 45° to *cd*, *c'd'* and *GL*. But this, as already remarked, is the assumed direction of the light.



25. This angle of 45° is the projection of the real angle made by the ray with either plane of projection, or, in other words, of the angle made by the diagonal of a cube with any of its faces, to all of which it is equally inclined. This is evident from an inspection of the figure, bearing in mind the fact that the angle of inclination of a line to a plane is always measured in a plane normal to the latter.



The assumed direction of Light is that of one Diagonal of a Cube.



Diagonal of Cube makes equal Angles ϑ with all Faces of Cube Angle CAB=CAG=CAF=ACE=35° 15'.

Now, if we take the side of a square as unity, its diagonal will be measured by $\sqrt{2}$, (1.4142), and the diagonal of the cube constructed upon this square by $\sqrt{3}$, (1.732). The angle ϑ, made by this diagonal with either face of the cube, will then be the angle whose tangent is $\frac{1}{1.414}$ or .707153, which is the natural tangent of 35° 15', very nearly. This angle is easily constructed at any point of a line, as *C* (Figure 20), by the following process: Erect at *C* a perpendicular of convenient length, *CD*, and complete the square *CDEF*. Draw *CE* and revolve it down upon *AB*; *E* becomes *E'*. Now complete the rectangle *CDGE* and draw *CG*: *GCE* will be the angle required, *GE* and *CE* being respectively equal to the side and diagonal of the square of *CD*. A pasteboard triangle similar to *GCE* will, however, save the trouble of geometrically constructing the angle ϑ.

26. The three sides of such a triangle, corresponding respectively to the edges of a cube, the diagonals of its faces and its own diagonals, hold, therefore, to each other the simple and easily-remembered relation of $\sqrt{1}$, $\sqrt{2}$, and $\sqrt{3}$. When the base (instead of the short side) equals unity, the short side is equal to $\frac{1}{\sqrt{2}}$ or $\frac{1}{2}\sqrt{2}$, and the hypothenuse to $\sqrt{\frac{3}{2}}$. When the hypothenuse equals unity, the short side equals $\sqrt{3}$ or $\frac{1}{3}\sqrt{3}$, and the base $\sqrt{\frac{2}{3}}$ or $\frac{1}{3}\sqrt{\frac{3}{2}}$.[2]

[1] In the discussion of this topic and those that follow, the reader is supposed to be familiar with the rudiments of descriptive geometry. Those who desire to refresh their memories in regard to such of these rudiments as are necessary for understanding these discussions will find them in a note at the end of this chapter, embodied in the form of maxims, for whose demonstration they are referred to the text-books on the subject.

27. Hereafter the angle 35° 15′ will in these papers be called the *angle* ϑ. The square constructed upon a given line as its side will be called the *square of the line*, and its diagonal the *diagonal of the line*. The latter term will also be used, when necessary, as a *measure of length*, the diagonal of a line being equal to the line multiplied by $\sqrt{2}$.

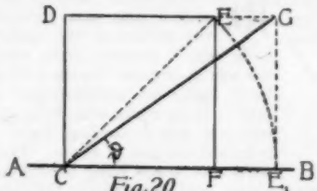
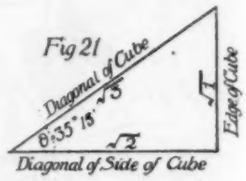
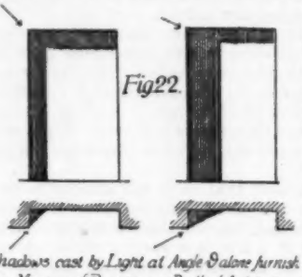


Fig. 20

Geometrical Construction of Angle ϑ: DE=CD CE'=CE; GCE' =35° 15'



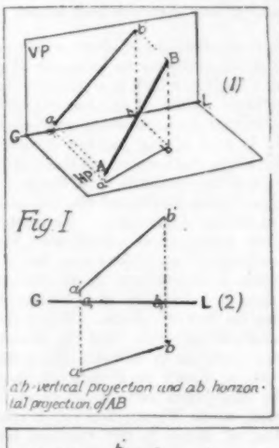
28. The advantages of taking the light at this angle can be indicated here only in part. Chief among them is the fact that the widths of the shadows cast by architectural features become thereby true measures of the amount of relief or projection of these features from the surface of incidence. Consequently, horizontal and vertical architectural members projecting or retreating equally from a vertical wall or other surface, as the jamb and lintel of a door, cast shadows of equal width upon it, which can only happen when the light falls at an angle whose vertical projection is 45°. In all the other cases the widths of the shadows are wholly misleading as indications of the amount of relief or projection (Figure 22). The incidental advantage derived from the use of the 45° triangle alike for the horizontal and vertical projections of the ray is by no means an unimportant consideration.



Shadows cast by Light at Angle ϑ alone furnish true Measure of Projection or Depth of Architectural Features

We are now fully equipped for the encounter with the problems of architectural sciography. The next chapter will discuss the general method.

Note. Figure I (1) represents in perspective a portion of two planes of projection commonly employed in descriptive geometry. *HP* is the horizontal, and *VP* the vertical plane, and their intersection, *GL*, is the ground-line. Let *A* and *B* be two points in space; *a* and *b* are their horizontal, and *a'* and *b'* their vertical projections. *ab* and *a'b'* are the projections of the line in space, *AB*. The lines dropped from a point in space to its projections on either plane are called *projecting-lines* (*Aa'*, *Aa*; *Bb'*, *Bb*); they are normal to these planes, and are themselves projected as lines perpendicular to *GL* (*aa*, *a'a*; *bb*, *b'b*). The projecting-lines of all points in a straight line to a plane of projection collectively form a *projecting-plane*



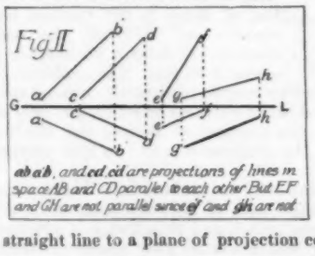
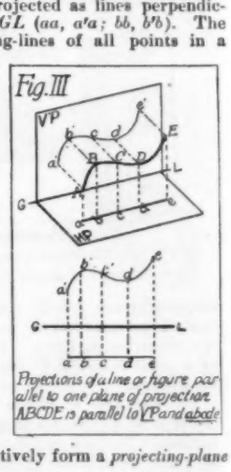
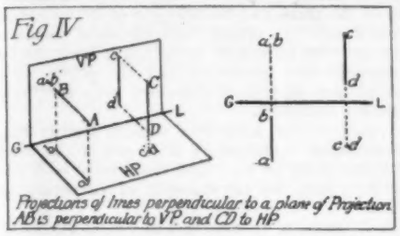


Fig II
G
L
ab a'b', and cd c'd' are projections of lines in space AB and CD parallel to each other But EF and GH are not parallel since ef and gh are not

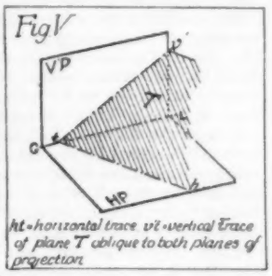


[2] It is worth remembering that the reciprocal of the square-root of a quantity is equal to the square-root of its reciprocal, and to its own square-root multiplied by its own reciprocal. Thus, $\frac{1}{\sqrt{\frac{3}{4}}}$ = reciprocal of $\sqrt{\frac{3}{4}} = \sqrt{\frac{4}{3}} = \frac{4}{3}\sqrt{\frac{3}{4}}$.

perpendicular to the plane of projection. In descriptive geometry the two planes of projection are represented as opened apart, so to speak, so as to coincide with the plane of the paper, being separated by the line GL, as shown in I (2). Lines and points in space are designated by capital letters, their projections by small letters.

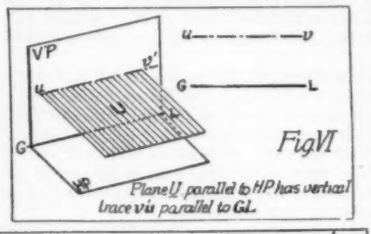


1. The two projections of a point are points lying in the same straight line perpendicular to GL. The projections of a right line are determined by the projections of any two points of that line; and the projections of a point are the intersections of the projections of any two lines passing through it.



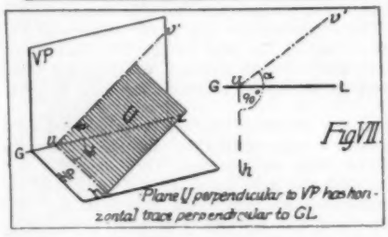
2. The projections on either plane of projections of parallel lines are parallel. Conversely, lines whose projections in *both planes* are respectively parallel are parallel to each other. In Figure II, ab, $a'b'$ and cd, $c'd'$ are projections of parallel lines, AB and CD; but EF and GH are not parallel because their vertical projections $e'f'$ and $g'h'$ are not parallel.

3. If a line or plane figure is parallel to a plane of projection, its projection on that plane is a line or figure equal and parallel to itself; upon the other plane it is a right line parallel to GL (Figure III). If a line is parallel to both planes of projection, itself and both its projections are parallel to GL.

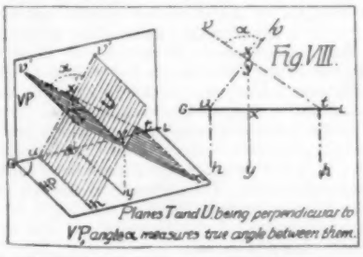


4. If a line is perpendicular to one plane of projection it is parallel to the other. Its projection on the former is a point; on the latter it is a line perpendicular to GL.

5. Every imaginable plane must cut one or both planes of projection in a line or lines called traces. (*a*) If a plane T is oblique to both planes of projection its traces ht and $v't$ are oblique to GL which they meet in a common point t. (*b*) If a plane V is parallel to one plane of projection it is perpendicular to the other. It has no trace in the former, while its trace in the plane to which it is perpendicular, is parallel to GL.

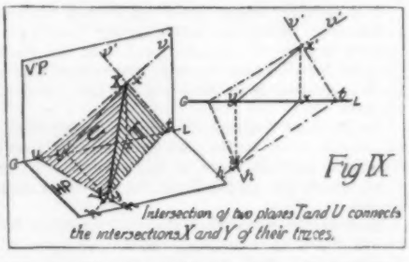


6. When a plane V is perpendicular to a plane of projection, its trace in the latter contains the projection of every point, line and figure lying in V.



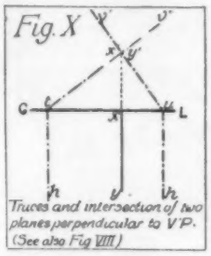
7. If a plane is perpendicular to one plane of projection and oblique to the other, the angle made with GL by its trace in either plane will measure its own inclination to the other. If it is perpendicular to both planes of projection, both its traces are perpendicular to GL and in the same straight line.

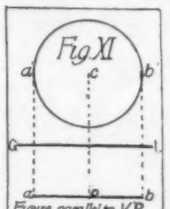
7 *a*. If two planes T and V have their traces in one plane perpendicular to GL, they are themselves perpendicular to the other plane of projection, and the angle between their traces in the latter, measures the inclination of these planes to each other. Consequently when these traces cross at right angles, the planes T and V are perpendicular to each other (Figure VIII).

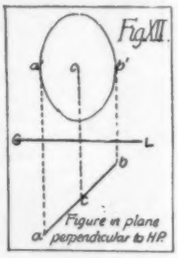


8. The intersection xy of two planes T and U in space is a line connecting the intersection Y of its horizontal traces with that x of its vertical traces. The vertical projection of XY is a line $x'y'$ connecting the intersection x' of the vertical traces with the point y' on GL which is the vertical projection of the intersection y of the horizontal traces. Similarly xy is drawn from y, the intersection of the horizontal traces to x the horizontal projection of the intersection x' of the vertical traces (Figure IX).

8 *a*. When one of the two planes is perpendicular to a plane of projection, its trace on that plane itself contains one projection of XY, (see 6). When both are perpendicular to a plane of projection, the intersection of their traces on that plane is itself the corresponding projection of XY. On the other plane the projection of XY is a line parallel to the parallel traces of the two planes.







9. If a plane figure is parallel to one plane of projection it is perpendicular to the other. Its projection on the former is a figure equal and parallel to itself; its other projection is a line parallel to GL and coincides with the trace of its own plane (see 6). If a plane figure is perpendicular to one plane of projection but oblique to the other, its projection on the former is a right line coinciding with the corresponding trace of its own plane (6), but its other projection is neither similar nor parallel to the figure. Thus a circle AB perpendicular to HP and oblique to VP has for its horizontal projection the right line ab, while its vertical projection is the ellipse $a'b'$.

[To be continued.]

THE ILLUSTRATIONS

[Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

HOUSE OF DR. W. B. PARKER, MARLBOROUGH ST., BOSTON, MASS. MESSRS. HARTWELL & RICHARDSON, ARCHITECTS, BOSTON, MASS.

[Gelatine Print, issued only with the Imperial Edition.]

THE LURAY INN, LURAY, VA. MR. GEORGE T. PEARSON, ARCHITECT, PHILADELPHIA, PA.

THIS illustration shows the building as recently enlarged.

INTERIOR OF ST. MARK'S, VENICE, AFTER AN ETCHING BY OTTO BACHER.

THE MISSION CHURCH, SANTA BARBARA, CAL. — AN OLD CALIFORNIA HOUSE. — COURT-YARD OF AN ADOBE HOUSE AT LOS ANGELES, CAL. SKETCHED BY MR. J. G. HOWARD, CHELMSFORD, MASS.

NO SUNDAY OPENING FOR THE METROPOLITAN MUSEUM OF FINE ART. — The interest that is felt in the proposition to open the Metropolitan Museum of Art to the public on Sundays is not confined to the progressive citizen of New York. People of this description in all parts of the country are equally interested in the matter, and one of them has recently taken a very emphatic course to show how thoroughly he believes the thing ought to be done. In recent conversation with one of the Trustees of the Museum upon the question, Mr. W. T. Walters of Baltimore, was given to understand that the principal reason why the Museum was not opened on Sundays was that it would cost $2,000 a year in addition to the present expenses of maintenance to do so. Mr. Walters upon his return home at once inclosed his check for $10,000 to the Board of Trustees, and wrote an accompanying letter, saying that the contribution was to be used in defraying the cost of keeping the Museum open on Sundays to the general public for five years. The matter was submitted to the consideration of the Board, and after consultation the check was returned, with the statement that the Board could not afford to accept the proposition. They were afraid of alienating strong support from the institution. — *New York Times.*

CHAPTERS FROM THE HISTORY OF CARPENTRY AND JOINERY.[1]

An Italian Tomb. From *Le Moniteur des Architectes.*

BETWEEN the decline of the Roman Empire and the tenth century there is a long and dark period, when little peaceful activity and much warlike strife went on in Europe, and this has left nothing for us to consider to-night. After this comes the period known as the Middle Ages, which may be roughly described as beginning a little before the First Crusade, and continuing to the Reformation. We have a great many remains of work done at that time in our own country, and the same is true of the time which followed it — the modern period.

England (and when it is practicable, London) will chiefly illustrate this history for us, though we must refer to Continental woodwork also.

There is not much builders' work of any sort except the most sturdy which has come down to us from the time of our Saxon kings, but there is — or was ten years ago — a small ancient timber church at Greenstead, in Essex, near Ongar, of which Sir Gilbert Scott gives a description in his lectures. He says that "the foundation of it can be traced back to A. D. 1013, which is more than fifty years anterior to the Norman Conquest. The structure is composed of cleft oak trees, grooved and tongued together by their edges, and let into grooves in horizontal heads and sills. The exterior of the trees was exposed on the outside of the church, the sapwood of which having long since perished, the furrowed and gnarled heart is now seen, presenting a most ancient and interesting appearance. It has been repaired, but I trust that its antiquity has not been compromised."

The Norman Conquest placed this country at the disposal of a race of very energetic and clever invaders, who were builders, sailors and shipbuilders. In every part of England Norman churches and castles, and in the great towns Norman cathedrals and monasteries sprang up, and the floors and roofs of these buildings required the skill of the carpenter, and some of the roofs — such, for example, as that over the nave of Peterborough Cathedral — were of not inconsiderable span, and carried a flat wooden ceiling. As Gothic architecture gradually developed, the roofs, timber-spires and floors, and the internal woodwork of churches and other buildings improved; though it must be admitted that, with our present notions and habits, we should have considered the carpenters of those early times clumsy; and it is impossible to deny that some of the earlier roofs of which the framing still remains are unscientific. The most important works of the carpenter are timber roofs. I had the honor of giving a lecture on this subject in 1885, and as many of you may have heard that lecture, and all can consult it in the building journals, I shall make my reference to this branch of the subject brief, pointing out, however, that the early carpenters used very large timbers, placed very close together, and of oak or chestnut, so that their structures, if heavy, were very strong.

I had to point out in that lecture how the use of a tie-beam was early abandoned, and a collar substituted as roofs became more steep; how in various ways curved ties, ribs and struts were introduced; and how the what is called a wall-piece, which it was always customary to use, was made to project inwards, and was supported by braces and grew by steps which can be traced in a succession of English church-roofs, till it became that peculiarly English feature, the hammer-beam. The finest specimen of the hammer-beam roof is that over Westminster-Hall, dating from A. D. 1397. The peculiarities of English roof-carpentery, when at its best, are well illustrated in this roof. They may be pointed out as the use of the hammer-beam; the use of vertical and horizontal main timbers within the lines of the principal rafters, to the almost total exclusion of raking-struts or braces — keeping all horizontal ties high up; the introduction of curved ribs and struts so as in some way to give an arched form to the main lines of the truss, and the filling-in of all spaces in the framework with small bars. In several respects these peculiarities are not those to be met with in modern roofs, but it must not be forgotten that the material was hardwood, and the joints were excellently made and pinned, so that the timbers were far more rigid when framed together than ours.

No one can, I think, look at this noble roof without feeling that, as a work of fine art executed in carpentry, it is one of the most successful that have come down to us. The roof really is Westminster-Hall, and nowhere have we an example of carpentry so thoroughly architectural.

Among the causes of its success, we must reckon the excellence of the lines of the truss and the regular repetition of truss after truss. The repetition of any framework good enough to span that vast space would strike the eye, for regular repetition is one of the acknowledged sources of architectural effect, but this framework is not only obviously sturdy, but it is full of beauty. The great curved ribs, the bold hammer-beams, the finely-carved angels that terminate these hammer-beams — each of these is a striking feature, and its force is intensified by its being repeated again and again all down the long space. Then the appropriateness and beauty of the mouldings and the filling-in heighten the effect, of which the force is further intensified by the introduction of a series of arched braces which run from one truss to another, and connect the whole into one roof, and by the skill with which the openings are formed where the dormer lights occur. In smaller, and perhaps in simpler, roofs, all these sources of beauty may, to some extent, be found, but nowhere else are they so perfect; and the impression they produce on the spectator is, no doubt, heightened by the great span of the hall, and the almost colossal scale on which the work has been done.

Referring you to my previous lecture for details of this roof, and for an account of other hammer-beam roofs, especially the singularly beautiful one which spans the Middle Temple hall, I propose to ask you to consider, for a little, timber-built dwelling-houses, a subject of no small interest.

In France there still remained till the early part of this century, and may linger yet occasionally, half-timbered houses dating from the twelfth century. One of them is described and illustrated in Violllet-le-Duc's "*Dictionary.*" It is a small three-storied house fronting the street, with side walls of masonry, which are corbelled out just below the level of the first floor. The front wall is formed of large heavy timbers, framed together, and with the comparatively narrow spaces that they leave filled-in with plastering.

The first floor overhangs the ground-floor, but the second floor is plumb over the first. The window-heads are partly segmental and partly semicircular, and cut out of the solid wood. The timbers are most elaborately mortised and tenoned together, the framing being more like that employed in joinery or shipbuilding than like carpenters' work.

From the thirteenth to the sixteenth century half-timbered work was freely employed in France in house-building, and the timbers are much more moderate in size, well-squared, very carefully put together, and where enriched the mouldings are truly worked. In these timber-framed structures we may, from the first, see well carried out the principle which was universally adhered to in Gothic carpentry in joinery; namely, that wherever the timbers met and were framed together, whether they were halved or were mortised and tenoned, they should be square. Consequently, all mouldings are stopped or made to run out to the face. There is thus as much wood as possible at the shoulders to the mortises and tenons, and the strength is kept for the places where it is most wanted.

It is almost invariably the case in these timber fronts that each story overhangs the one below it, and at the top there is either a gable with a finely-worked barge-board, or, less frequently, an eaves-gutter and a roof, usually broken by one or more dormers.

In the general treatment there was a tendency for the timbers to be lighter as time went on, otherwise the changes in mode of framing, etc., were not great, except that in later examples you will find more diagonal braces. The ornamental work, however, *e. g.*, the carving, the enriched barge-boards and the heads of doorways and windows, partook always of the character of the moulding and carving in general use at the time.

It is specially characteristic of French timber-built houses that the plates into which the overhanging joists are pinned are almost always beautifully moulded, and that the gables and the dormers (where those features occur) have curved timbers, so combined with their barge-boards as to give a distinctly arched appearance to that feature.

In England timber-built houses dating from before the fifteenth century are very scarce; we have some of that century, more of the sixteenth, and still more of the seventeenth; nor did the change in taste, which we call the Renaissance, very radically affect our timber houses.

Had it not been that they all perished in the Great Fire, we should have, no doubt, still many examples of timber buildings in London; as it is, I can only point you to one or two. The most accessible specimen is on the south side of Holborn, nearly opposite Gray's Inn Road, where the gabled fronts of several houses, modernized on the ground-floor, retain above the kind of construction which caused this ancient Company of Carpenters to hold at one time the

[1] A portion of a lecture delivered by Prof. T. Roger Smith at Carpenters' Hall on Wednesday, Feb. 6.

most important position of any of the London companies that had to do with building.

A timber-built house was what is now usually called half-timbered. It had a low plinth or foundation of masonry. The fabric of its walls consisted of vertical timbers framed into a plate resting on the foundation and into another above, and usually strengthened or stayed sideways from one to another. Usually the first set of timbers only reached to the top of the ground story. The joists of the first floor, which were really massive timbers, quite unlike our modern joists, overhung, and the framing of the upper part consequently could be carried on a plate supported upon the ends of the joists, and so could project beyond that of the ground story. Where this occurred at the corner of a street, a massive post, often much enriched with carving, was usual, and many of these posts remain in country towns, even though the houses have been modernized. The spaces between the timbers were filled with brickwork, or more often lathed and plastered. Occasionally they were filled with tiles, and sometimes with woodwork, or even the whole boarded over.

A great many good manor-houses were constructed in this manner in the North of England, where a series of fine old half-timbered houses remaining in Cheshire and Lancashire may serve as a basis for some general remarks. The dates of the most famous examples belong to the sixteenth century, or are near it. Thus, out of a list of thirty-eight, I find seven to belong to the fifteenth century, the earliest date being 1460, and nine to belong to the seventeenth century, the latest date being 1648, but the remaining twenty-two are sixteenth century. It is astonishing to note how small the differences are between the early and the late examples. Almost without exception these homely, but very striking, houses are of two low stories only. The upper story usually overhangs, but not in a very marked way. The gables are never of a sharp pitch. The roofs overhang considerably, and are finished by plain barge-boards usually without finials, pendants, or carving. The walls and gables are constructed of strong timbers, well-framed together and pinned at the joints; almost always stained a strong black, and with the spaces between them filled-in with plastering kept quite white, so that the contrast is striking. There seem to be two schemes of arrangement for the timbers, but both occur sometimes in the same building in different parts. In the simpler scheme the timbers are most of them uprights, fixed very little more than their own width apart, and with a few horizontal timbers hardly breaking the monotony. Good examples of this are Agecroft Hall, Cheshire, and parts of Bramhall Hall, Cheshire, and Worsley Old Hall, near Manchester. In the other scheme the timbers are about three times as far apart as in the last. Horizontal transoms are more frequent, and there is a strong tendency to form panels that are nearly square, though oblong upright panels are also common.

These panels are filled-in by smaller pieces, often so arranged as to form a diamond, arranged with its corners resting against the sides of the main square, and having the inner face worked into some sort of quatrefoil — which figure is constantly employed in many different forms. Sometimes the long panels are filled with diagonal braces — a whole row of these sloping all the same way — but it is interesting to notice that crossed diagonal braces, which are quite common in French examples, rarely occur in the panels, though in some instances a gable-end is covered with a kind of reticulation formed of crossed beams. In the Hall i' th' Wood, a late example near Bolton, attributed to the middle of the seventeenth century, nearly every form of enriched panel is used, including panels formed by the use of curved lines, obtained, probably, by selecting naturally curved pieces; and in this and some other examples the builders seem to have been bent upon covering every part of the surface with elaborate and startlingly brilliant patterns; but generally the richness is kept concentrated on such places as gables and bands of ornament, and considerable portions are kept simple in treatment. The extremely strong contrast between the black timber and the white filling-in makes all these buildings a little startling in appearance.

I have mentioned that in these north-country examples the overhanging of the upper story is not always met with and not made conspicuous. I ought to add that when it occurs it often is worked into a kind of shallow cove.

If you compare these examples with such as can be found nearer London — say at Penshurst or Tonbridge — some points of contrast present themselves. In the south-country houses the roofs are steeper, the barge-boards more ornamental and often have pendants, and the buildings are sometimes higher. The quatrefoiled and other patterns in panels rarely occur, and the timbers are not so massive, nor are they made so black. On the other hand, the upper story generally overhangs very decidedly, and so as to cast a bold shadow; and very often a bay-window is thrown out in the lower story, the front of which projects exactly as far as the upper timbers overhang, so that the face of the bay is carried on by the face of the upper part of the building in the story above.

One example of a timber-fronted building of the most ornamental class, containing also a fine hall, survives in London in Crosby Hall, Bishopsgate, and, though various alterations have been introduced into the interior, which is now a restaurant, I believe the front to the street, though it has necessarily been much repaired, gives a good example in the original form of what such places as this were at their best.

Following the plan I have before adopted, let us consider for a moment the carpenter engaged upon these timber-framed houses as an artist. Very few persons will deny that these buildings possess a great charm. They, of course, have the antique air which adds a touch of something like romance to the actual beauty of any work of architecture; but they have intrinsic claims on our admiration. One of these is that they display their structure. In all buildings where the construction can be traced at a glance the mere fact of seeing how the fabric holds together seems to rivet attention and to satisfy the instincts of the spectator. This structural work has, moreover, the quality of breaking up and, so, enriching the surface of the wall. This pleases the eye, and, what is more, it adds to the apparent size of the building, so that quite a modest house, not much more than a cottage, rises into importance. The bold shadows thrown by the overhanging story, where it occurs, and by the projecting roof, are sources of striking effect when the building is lighted up by sunshine, and if the panels have ornamental filling-in, or if any of the prominent timbers or the barge-boards have carving or are moulded, such a touch of refinement enriches the whole. Simplicity in the general forms united to a good deal of variety, and richness to a certain extent, concentrated upon well-chosen points, are characteristic of the greater part of our English half-timbered houses and halls, and such a combination is almost sure to succeed.

Examples of English half-timbered work are to be found in many of our oldest towns, and also in country places. They exist, for example, at Chester, Shrewsbury, Tewkesbury, Coventry, Bury St. Edmunds, Canterbury; Weobley, in Herefordshire; Sherborne, in Dorsetshire — all of them places of remote origin. The most interesting country examples are, of course, more widely scattered, but a good many can be found within reach of Penshurst and Tonbridge, including almost the whole of one little village — Chiddingstone.

There are timber houses in many parts of the continent of Europe, as well as France. In several parts of Germany and Switzerland timber houses, often of great size, and sometimes of great beauty, are common, and the same is the case in Sweden and Norway, but as these buildings differ altogether from our timber houses, and would require almost an evening to themselves, if justice is to be done to them, I shall not attempt to notice them to-night.

It can hardly have escaped at least some of you that these timber buildings in England have been described as resembling one another very greatly, and yet that the date of many of them is long past the time when a radical change of taste took place. That transformation, which we now call the Renaissance — or the revival of Classic art — began in Italy in the fifteenth century, spread to France, and made its first appearance in this country at or soon after the beginning, in 1509, of Henry VIII's reign; but after that there was a long period of transition known by the names of Tudor and Jacobean before the new style completely prevailed, and it is interesting to note that even long after the details of most stone buildings, especially in the great cities, had become quite Italianized, the old traditions influenced the builders of timber houses. In many country places they lingered on very late indeed, and in some sorts of woodwork they still exist; as, for example, in the ornaments and mouldings of some sorts of barges and of many country wagons, which resemble to this day those in use in Gothic buildings.

In other branches of the carpenter's art the change in taste was more rapidly visible. Such open-timber roofs as belong to the seventeenth and eighteenth centuries are entirely different in their details and ornaments from the Gothic ones, and as time went on ornamental carpentry became much more scarce than it had been, and carpentry after the sixteenth century is chiefly remarkable for the scientific skill of the carpenter.

Carpentry was, however, largely employed in providing the shell or form of domes, high-pitched roofs and turrets, which, covered with metal or tiles, formed conspicuous ornaments on the sky-line of Renaissance buildings, and in this way it contributed to the architectural effect of many striking buildings. For example, the external dome of St. Paul's Cathedral, in London, and the Invalides, in Paris, are timber-framed and covered with lead in one case, and copper in the other.

One more chapter — a brief and imperfect one — we will devote to joiners' work. Of very ancient joinery we have a few, but very few traces, of the sort which ancient carpentry has left. Of Gothic, or mediæval joinery very little remains from as far back as the thirteenth century; more remains from the fourteenth, and a vast amount from the fifteenth and the early part of the sixteenth. These examples are chiefly in the benches, stalls, screens and other fittings of cathedrals and churches.

Many noble examples of transitional joinery exist in the shape of the great staircases, the panelled walls, the screens, and occasionally the ceilings of the many fine mansions erected in Elizabeth's reign; and while, as we have just seen, carpenters' work lost much of its ornamental importance at the time when the Renaissance became fully established, that of the joiner continued to be prominent. Of this, the choir-stalls and organ-screen at St. Paul's Cathedral, and the fittings of Wren's churches generally, may stand as examples.

In the joinery both of England and France, executed at the time when Gothic architecture prevailed, we find, as is well pointed out by the great French writer, Viollet-le-Duc, two main principles: 1. Great economy of material. 2. As much strength as possible secured where the parts join. It is an almost invariable rule that all the framing is of moderate dimensions. The panels are always of

moderate width, so that they can be cut from one piece of wood, and no pieces of large scantling or great thickness are introduced. The material was mostly hard wood — nearly all oak. It was selected with care; a great deal of time was devoted to seasoning it, and it came to be looked upon as very precious, and if material could be spared, even at the expense of extra labor, the preference was given to the economy of material rather than economy of labor.

The other point, the care with which the joiner of the Middle Ages secured as much of the stuff as possible at the places where his joints come, can hardly have escaped the notice of any practical men in my audience who have examined a piece of old framing, and it affects the design quite as much as the construction.

Wherever two pieces are framed together, it is usual that both — or, if not both, at least one, and that one usually the one in which the mortise is cut — should be square. Consequently, in such a piece of work as a door, if there are mouldings or chamfers on the styles, they are stopped before the point where each rail is framed. In much Gothic panelling, therefore, the sides that enclose each panel are stop-chamfered or stop-moulded, the top of the panel (*i. e.*, the bottom edge of the rail) is moulded, but the bottom of the panel, *i. e.*, the top edge of the lower rail, is very often splayed; and the system which we are all familiar with, of mouldings mitred round a panel, was almost unknown in England till the sixteenth century; nor was it the practice to plant mouldings on as we now often do, or to make use of the projecting mouldings, called bollection mouldings. Thus, you perceive, the framework of every panel was quite different from the framework of a modern panel in appearance. The panel also sometimes differed; it was often enriched by carving on it an ornament in relief. This ornament was very often what is known as a linen-fold panel — a conventional sort of imitation of a piece of cloth nailed upon the panel, and extremely rich in effect in many cases.

Although curved forms were largely used in the stone architecture of Gothic buildings, the designers of joinery were very chary indeed of introducing them. Sometimes imitations of small arcades, cut out of not very thick stuff, and similar small decorative features, occur; but, generally speaking, all the main lines of the joinery are straight, so as not to cut across the grain of the wood. In rich and elaborate work there is hardly any limit to the degree of ornamental work introduced, and here, of course, circular work occurs at times. Perhaps no example within reach will give you so good an idea of what was accomplished when joinery was employed as the ornament of a very rich building, as the stalls in Henry VII's Chapel at Westminster Abbey — a work executed just at the time when Gothic architecture was about to give way to the new style, and as florid and ornate as possible.

The general appearance, however, of even highly ornamental Gothic joiners' work is decidedly dignified, if not severe. The squareness and regularity of the leading lines, the frequency of the panels and the smallness of the mouldings all contribute to produce this effect. Much modern joinery has been done from designs made by men who thoroughly understand the old, and, for our purpose, some of it is as good as the old. For a good specimen of what I call the severe quality of Gothic joinery, I think you may go to the new Law Courts, from Mr. Street's designs, where you will see in the wainscot fittings of the courts and other parts the style of the thirteenth century thoroughly well carried out. For an equally exact reproduction of the richest joiners' work of the fifteenth century, I would ask you to go to the Houses of Parliament, especially the House of Lords, where you will see elaboration carried to an extent for which only a national work of that sort affords the opportunity.

The joiner's work, like that of the carpenter, was affected by the change of taste at the Renaissance, and was, I think, earlier and more completely transformed than the mason's and carpenter's work. It is not an unusual thing to see in an Elizabethan manor-house, where the general forms retain a great deal of Gothic character, panelling in the hall and staircase of thorough Classic design, and possibly a screen in woodwork (such, for example, as the one at Audley End), where imitations of Italian pilasters, columns, arcades, and so forth, are executed in wood cleverly enough, and with excellent effect of their kind, but of a character entirely and totally different from that which a screen executed a century earlier, or even fifty years earlier, would have had. Something of this difference exists, indeed, between the roof of the Middle Temple hall and the wooden screen thrown across the lower end of the hall to cut off a corridor. The roof we might call Transitional, the screen almost complete Renaissance.

The best specimens of English joinery after the sixteenth century are most of them largely indebted to the art of the carver for their effectiveness. St. Paul's Cathedral shows this both in the choir-stalls and the woodwork of the library, and, though the carving there is a miracle of skill and richness, and certainly combines consistently with the fabric, I doubt if the stalls at St. Paul's are as fine pieces of joiners' work, or as good artistically, as any similar piece of good Gothic stall-work; and I am quite sure that the general run of Renaissance joiners' work is less constructive, less thoughtfully designed, and I believe, to most tastes, less pleasing and interesting than the Gothic.

Between the mediæval and the revived Classic, or, as it might be termed, the imported Italian, there is a great borderland, where work known as Elizabethan, Jacobean or Queen Anne occurs, both in joinery for domestic purposes and in furniture. More than one of the lectures of this course seems likely to touch a little upon this, and this is a reason, if the length to which this paper has already extended were not in itself a sufficient excuse, for not entering upon what has a great deal of interest for us at the present day in connection with the modern revival of Queen Anne work. Suffice it to say that in its combination of forms and ornaments drawn from various sources, this transitional work often forces us to admire it even when we feel that much of its charm rises from its being irregular. Nowhere is such a work more in place than in joinery, especially for domestic use; and a vast amount of picturesque effect is obtained at the present day by the use of joinery for dwelling-houses designed in close imitation of the old English and Anglo-Dutch work, to be even found scattered about in many parts of London that have not yet been modernized.

Under no circumstances would the time have allowed me to go much farther in considering ancient joinery, and, with your permission, we will now break off and turn to the very latest chapter in the history of works in wood — a chapter which is perfectly new — of special interest to us in this hall, and, I sincerely trust, of vital importance to the craft.

By the liberality of one of its members — Mr. Harben, a member of the County Council for London — the Carpenters' Company is enabled to offer a series of prizes especially for the encouragement of skill and design in joinery as art, and in carving. Our technical examination has been directed to science and practical knowledge in carpentry and joinery as construction, and remains so. This is a new departure. For this Company it is a privilege, and no small responsibility, to be called to administer this gift through a series of years. For you it is an opportunity.

The prizes offered this first year are a first series, and there is a prospect that they will be carried farther in the future if the designers and craftsmen of London and the country generally encourage the Company by assisting us to make this movement a success. I appeal to you and to every designer, carver, and high-class workman who may become aware of it to respond to the invitation which is addressed to you by throwing yourselves heartily into the competition, and during the months between the present day and June, preparing specimens of the best you can do.

The subjects proposed for prizes are, it is hoped, varied enough and suitable enough to give opportunities to many. The first is a hammer-beam in hard wood. In designing this, you will remember that it is to be in a horizontal position, to be seen from below at about ten feet from the eye, that the end of it is free and projects, and the remainder is part of the framing of the truss of an open roof. If competitors guide themselves by old examples, as I hope they will, remember that the hammer-beam was used from during the fifteenth, sixteenth, and part of the seventeenth centuries, and that the details and carving must correspond with models within those dates. Of course, it is open to competitors to imagine a quite modern hammer-beam roof, and originate a modern treatment; but this is a very much more difficult thing to do even tolerably well.

Whatever period is chosen, such mouldings as are introduced should be such as will be seen from below, and will be effective when looked up to, and at ten feet distance. Carving is, I think, only appropriate at the fore end of the beam; but here a fine opportunity is offered to the carver, and the competition will no doubt turn mainly on the skill with which this is designed and executed, and adapted to the situation and the height, and also to the material, not forgetting that it will be one of a series, and so must have an outline that will bear repetition. It will make the hammer-beam more complete if it is mortised for the brace and post, and that should tenon into it; and if any of its mouldings are to mitre with those on the brace, for those on the hammer-beam to be properly cut.

The pieces of barge-board and finial are, of course, intended to occupy the apex of at least a two-story building. There is very great scope for variety of design in this subject. The examples begin in the fourteenth century, and barge-boards have continued in use to the present day. Some are cut, some only moulded, some pierced, a few partly carved. The finial is always moulded, and gives a good opportunity for design and for skilful execution.

A bench-end is a comparatively familiar subject. What, of course, is meant is one of more or less ornamental character. It is difficult to point to many good old Gothic ones in London, but very many modern ones of excellent design and execution are scattered about our best churches, and in Wren's and Gibbs's churches specimens of Renaissance designs are to be met with. In dealing with this subject, it is to be hoped that the competitors will remember that it is the whole thing, not the bits of ornamental carving which they will introduce that will be considered. Good outline, good proportions, good mouldings, as well as good execution of skilful carving will, accordingly, each play a part.

A table-leg presents the peculiarity that it is looked down upon. It requires both to be strong and to look strong. The great risk in designing it is making it clumsy or commonplace. It is not a subject into which it is easy to introduce carving successfully, for as soon as the leg begins to look as if it has to carry the carving, it begins to lose the look of carrying the table. Good enrichments to mouldings are, however, free from this danger.

A frieze is preëminently a carver's subject, and demands a knowledge of the nature of surface ornament, and power as a designer and carver. The work must be very good, because it is to be opposite

the eye, but it must not be extraordinarily delicate, because it is to be executed in soft wood. In such a subject, if animals or figures are introduced, they add extremely to the effect if they are well done; but if the carver is not sufficiently skilled in this branch of his art he had better not introduce them.

A bracket is perhaps almost more than anything else an open subject. Usually it is so treated as to be carved work entirely, but it may quite as appropriately be exclusively moulded, or a combination of the two. Remember that, however managed, the idea of support must not be lost, or the bracket is a failure.

The prize for a chair of moderate value offers in some respects the best opportunity to a man of genius. All the other subjects are, more or less, of an ornamental nature, and offer considerable scope for elaboration. Here the subject is familiar. The limitation of cost shows that the article must be a useful one, and that its excellence must be in itself rather than in its ornaments. At the same time it is quite possible for a skilful man to improve upon the ordinary chair, and it is very probable that if he really does so, his design may have a success outside the walls of Carpenters' Hall.

There is one prize which is intended to be won by skill and readiness in designing and drawing. The competitors will be set a subject unknown to them till they enter the examination-room, and will have two hours in which to do their best with it. No limitation is set as to what drawing materials are to be used, and you will note that competitors are to bring their own. Probably the best for such work is tolerably soft pencil. Of course, I have no clue, and can offer none, as to what the subject will be; but it seems to me that it will be likely to be of the same general description as the specimens of work — that is to say, something requiring good joinery and admitting good carving; and, of course, its merits will be judged as a piece of artistic design and draughtsmanship. Last, but by no means least, there is a prize for beginners in the art of carving in wood.

In closing these remarks, and with them this lecture, I have only to express very earnestly the hope that there may be a very good competition for each of these Harben prizes, and my conviction that to win any of them is likely to do good to the successful competitor by bringing him into notice. The judges will award no prize unless they are satisfied with the work, and will not be desirous, so far as I can foresee their intentions, to admit or pass anything that is bad or indifferent. In the construction examinations a very high standard was set last year, and will be maintained this year; and there is no reason why the same thing should not be done in the adjudication of the art prizes, and every reason why it should be done. To take a prize here will, therefore, be creditable and honorable to the successful candidate, and on this account, quite irrespective of the money value of such prize, will, I venture to predict, be of advantage to him in his career in life.

BUILDING LAW.

THE UNIFORM BUILDING CONTRACT.

MR. O. P. HATFIELD in a letter published in the *American Architect* for March 2, suggests that if the architect is made the owner's agent (as proposed by the "Standard Contract") there would be no "suspicion" of the personal responsibility of the former for work ordered by him.

We think that Mr. Hatfield, as well as the framers of the "Standard Contract," misconceive the true relation of the architect to his client, and overlook the wide departure from business principles and professional practice involved in an attempt to give the architect a power of attorney to order what he pleases. In special cases the owner would doubtless be willing to enter into such a contract; but ordinarily the idea would be rejected as soon as understood. We are aware of no relation in life where such a power is commonly given by a principal to the person he employs. Even an attorney-at-law has no authority to compromise his client's case.

But we think that there is no ground for the suggestion that if the architect were the owner's agent he would himself escape the danger of litigation. On the contrary, as more fully set forth in the *American Architect* for February 23, 1889, there is, in our opinion, little room to doubt that the proposed "agency" of the architect would create more trouble than it would cure. Our correspondent invokes the authority of Professor Parsons in support of the architect's unlimited agency; and quotes a provision from a form said to be contained in his "*Laws of Business*" making the architect the agent of the owner for the purpose of *superintending* the work. Such an agency would give no right to order *extras*, and the power to order extras given by section three of the "standard form" is what we object to most. Moreover, the book referred to contains no such contract or any form of building contract whatever. Perhaps Mr. Hatfield's friend had some English book in mind; English architects very generally insert some such clause in their contracts, though the practice has been severely condemned. See the introductory chapter of Sir Edmund Becket's "*Book on Building*."

We agree with Mr. Hatfield that a proper uniform contract blank would be extremely useful.

THE LUMBER DEALERS' DEMAND FOR A NEW LIEN LAW.

THE joint judiciary committee of the Massachusetts Legislature has given the lumber dealers "leave to withdraw." This ends the matter for this year at least.

THE FINAL PAYMENT CLAUSE IN NEW YORK CONTRACTS.

SAYVILLE, N. Y., February 18, 1889.

Question. — Several years ago I had occasion to consult a lawyer in relation to the lien law in this State [New York].

I was advised that it was not necessary to defer the final payment until the time had expired in which liens could be filed. The lawyer said that it would be perfectly safe to write contracts for building in such a manner that the last payment would be due ten days after the work on the contract was finished. He claimed that it was the right of material-men and others who might be entitled to liens to know the terms of a contract (as to payments) under which they were furnishing material or labor and that in order to hold the owner responsible they must record liens before the time when payment is due. The substance of his advice was to the effect that so long as the owner made payments when the contract said that they were due and not before he was released from all responsibility for liens unless said liens were recorded before the time when the payment became due. From what you say about liens in your law department I infer that the above advice is not reliable, and I would like to know positively whether it is or not. In case the advice is sound of course it is not necessary to keep the contractor waiting three months for his last payment which is sometimes quite a hardship. As I understand it, your legal department has been established for the discussion of questions of this nature, and I believe such a department will be of great service to the profession, as it is sometimes difficult and expensive to get reliable information relating to building law. If you can give me the law on this lien question without too much trouble I think it would be useful to many architects, builders, etc., as well as to

Yours truly, I. H. Green, Jr.

Answer. — In reply to the above inquiry it may be said with emphasis that it is *not* safe to pay all the contract money out before the last day for filing liens has elapsed. Wherever the mechanics' lien attaches irrespective of the state of accounts between the owner and contractor, the danger of paying out all the money while it is still possible that liens may be filed is of course obvious; where, however, as in New York, the owner is protected as to payments made before the filing of the lien, there is some ground for the opinion referred to by our correspondent to the effect that the last payment may safely be made before the three months have expired. But the New York law contains another provision which practically goes far to destroy this protection extended to the owner. Section two provides that if the owner "for the purpose of avoiding the provisions of this Act or in advance of the terms of any contract" pays the contractor, he shall be liable to the material-men to the extent of the monies thus paid. That is if the plaintiff in a lien suit can satisfy the jury that the money was not due from the defendant to the contractor at the time it was paid, and was paid collusively, the owner will have to pay the money over again. The owner has not only to face the well-understood danger that the jury will find for the less wealthy party to the action, irrespective of the weight of the evidence, but also labors under the very serious disadvantage of having practically to prove that the contractor was legally entitled to the money at or before the time when it was paid. Now everybody knows that partial payments on a building contract are made in ninety-nine cases in a hundred before they are strictly due according to the terms of the contract. Some little thing has not been done, for the omission of which the owner may, if he choose, refuse to pay the contractor; but in most cases where the work is progressing satisfactorily he is perfectly willing to make the payment. Now in a lien case under the New York law the owner must be able to satisfy a jury that the money was strictly and legally due when paid.

It is to guard against the danger of not being able to prove that none of the contract money was paid before it was due, that it is expedient to hold a portion of it back till all risk of such litigation is over, that is, until three months have elapsed since the completion of the contract. As already pointed out in this Department the real and practical object of protective clauses in a building contract is not so much to vary the law in favor of the owner as to guard him against the adverse verdict of a jury based on sympathy or a mistaken view of the evidence.

COMMUNICATIONS.

MOTTOS.

NEW YORK, N. Y., March 7, 1889.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Would you kindly mention a few pithy and suggestive mottos or maxims, English preferred, suitable for dining-room, hall and library? Have any such ever appeared in previous issues of your paper?

Yours respectfully, EMIL GINSBURGER.

[As English phrases such as "Let good digestion wait on appetite" are

hackneyed in the last degree we give below some which have not been so hard-ridden.

"*Les fous font des festins, et les sages les mangent.*"
"*Appetitus rationi pareat.*"
"*Magister artis ingenuque largitor, Venter.*" — Persius.
"*Ventre affamé n'a point d'oreilles.*"
"*Sine Cerere et Baccho friget Venus.*"
"*Sero venientibus ossa.*"
"Beware of a man of one book."
"A book is a book although there is nothing in it." — *Byron.*
"In the four quarters of the globe, who reads an American book?" — *Sydney Smith.*
"Books cannot always please, however good." — *Crabbe.*
"Welcome ever smiles, and farewell goes out sighing." — *Shakespeare.* — Eds. American Architect.]

NOTES AND CLIPPINGS

Present Navigation in the Panama Canal. — The fact that a British vessel of 270 tons has passed through the Panama Canal from Aspinwall to Chagres, a distance of fifteen miles, shows that the canal is something more than a scratch on the earth's surface. It is more reasonable to suppose that such an enterprise will be completed than it is to believe that it will be abandoned. — *Atlanta, Ga., Citizen.*

A Narrow House in New York. — It is possible to swing a cat, if any one ever did want to apply that time-honored, but rather useless system of measurement, in the four-story brick house at the northwest corner of Lexington Avenue and Eighty-second Street. But to do it without damage to the cat and the furniture, puss must be swung from north to south, not from east to west, for though the house stands upon a lot 102 feet deep, the land is only five feet wide, the actual width of the building being four feet. The sills and lintels are of white marble, and three bay-windows run up from the first floor to the roof. It is probably the narrowest brick dwelling-house in the city, if not in the country. Small, round windows, like port-holes, let light into the basement, and the doors are mere slits in the brick walls. It was built in 1882 by its owner, Mr. Richardson, who lives in it. He is a brother of Captain "Ben" Richardson, the eccentric millionnaire, who died in Harlem the other day, and is a wealthy builder and contractor. He owned the lot, and being unable to sell it at a good price on account of its narrowness, he determined that it should not be sacrificed. So he built a house on it for himself, and, though the rooms on the inside are barely more than three feet wide, the family say they do not feel uncomfortable in their cramped quarters. — *New York Tribune.*

Factory Chimney Construction. — A tall chimney is seldom a very pleasing architectural feature; yet it is an important part of factory construction, requiring special architectural skill, a point not often acknowledged by either architects or owners. A manufacturer contracts with a boiler-maker for a certain amount of power from a given quantity of coal, and if he fails to perform his contract there is trouble, when the chimney may be the whole cause of the failure. If a chimney is required to take away gases or fumes from retorts and furnaces, then it must be built to a height sufficient to carry these clear off the surrounding premises. This height can only be determined by a knowledge of the nature of the gases, etc., and the situation of the factory. In the following remarks it is only intended to deal with a chimney necessary for ordinary factory purposes. In order to give the required draught to the common steam-boiler, the chimney should be not less in height than 80 feet above ground surface at its base, and not exceed 150 feet unless there is higher land in the immediate neighborhood. To find the necessary area of a chimney, first ascertain as nearly as possible the area of the grate-bar surface of the various furnaces; then if the chimney is to be 80 feet in height above the ground surface, multiply the area of the grate surface in square feet by 14; for a chimney 100 feet high, multiply by 11; for a chimney 120 feet high, multiply by 12; and for a chimney 150 feet high, multiply by 9.8, and the quotient in each case will be the area of the chimney in square inches at its narrowest point. The area at the top of a chimney should never be less than at the base; some engineers say that it should be greater, because the smoke and air entering the chimney at a very high temperature ascends rapidly, but as it cools in its passage through the flue its progress gradually becomes slower. A square chimney was erected only last year, in Hamilton, for the Canadian Screw Company. It is 100 feet from floor of boiler-house to top of cope. The flue has an equal area at top and bottom of 2,116 square inches. It was designed to give draught to three boilers of 100 horse-power each, two drying ovens and four annealing furnaces. To it also was connected an eight-inch pipe from the drains. It is now working and giving perfect satisfaction. The foundations ought to be deep enough to take all the footings below the reach of frost, each course projecting beyond the one above not more than two-thirds of its own depth — thus increasing until a projection of foundation is gained beyond the line of the base of the chimney, equal to one-twenty-fifth of the height of the chimney above the ground surface. This is necessary for the stability of the chimney upon a good hard bottom. On soft land or bad bottom, the area of the foundation must be increased so as to spread the weight over a surface sufficient for its support. The strongest chimney is one built entirely with brick above a stone foundation, and the best form of plan is the octagon, the draught of which is almost as good as the circular, and the cost of the building is considerably less. In setting out the brickwork, start at the top and figure downwards. If the width of the flue is less than five feet, then the walls of the chimney will only require to be one brick for twenty-five feet below the cope, and if the outside of the chimney has a batter of one-fourth inch in every foot, the thickness of the walls at the base will be what they measure. The inside face of brickwork above foundation ought to be of fire-brick, carried about one sixth the height of the chimney, and air space is not necessary, unless where a strong flame (as from wood fuel) would be constantly striking. Finally, have as few openings as possible into the chimney, and upon no consideration allow waste or exhaust steam to enter it. — *The Architect.*

TRADE SURVEYS

The generally prosperous condition of the country is manifested in various ways. The volume of imports and exports for the first two months exceed all previous records and the same is true of imports and exports for seven months past. The distribution of merchandise is also in excess of former years according to trunk-line statistics and clearing-house returns. At the same time there is a marked downward tendency in prices as shown in iron, coal, lumber, oil, etc. By many this tendency is regarded in an unfavorable light but coming as it does before the opening of the active year's business, it helps to lay a solid foundation for future trading. Those who closely follow the ups and downs of trade are familiar with the depressing or exciting influences that fluctuations in values have, and often too, when there is no legitimate cause for a modification of opinions. Just now the general markets of the country are liable to price fluctuations when the condition of stocks and the condition of demand do not at all warrant such fluctuations. The secret of the whole matter is this, that there is a certain or rather an uncertain surplus producing capacity, machinery, labor, money, plant, etc., and the question is, will all or any, and if so, how much of this surplus capacity be employed. If all, then prices will advance, if none, then prices will decline, if a little, then there will be a fluctuation this way and that as the country exceeds in its consumptive demands, the limits reached last year. The third month of the year like the first and second, have brought more railroad, mining, financial and business activity than last year if accustomed authorities are to be believed. In New York plans were filed during February for 298 buildings, to cost $5,477 475.00 or 98 over February, 1888, when the estimated cost was $3,271,980.00. During four days this week permits were taken out in Philadelphia for over 600 dwellings according to the permit file in the inspector's office. At Pittsburgh over one million dollars' worth of new work has been placed in the hands of architects within a month to say nothing of two bridges to cost $900,000, one below the city to cross the Ohio River at Brunots Island, and another across the Allegheny River at the point where tradition says Washington crossed on a raft when executing his first commission for Governor Dinwiddee of Virginia. Architects in Chicago have not entered upon the heavy work of the season but are confident of abundant work. An unusual amount of hotel building is on the boards. Theatres, halls and public buildings will engage more than average attention and capital this year. The same is true of bank buildings. Within thirty days, a record of thirty new bank buildings has been made, costing from $300,000 down. The record of projected educational institutions, churches, asylums and the like is quite large. Another very important feature is the amount of railroad terminal work. All of the Eastern and Western trunk lines have schemes and programmes to carry out involving unusual outlays. At Philadelphia large sums have been invested in river-fronts. Also water-fronts have been purchased at Staten Island. Freight-handling facilities are to be improved all along the Atlantic Coast; whatever else the railroad companies have to complain of they cannot fairly grumble at declining traffic. Prices in nearly all directions are lower than last fall, and the general feeling in trade circles that they have touched rock-bottom is helping confidence. The textile goods manufacturers are producing, all through, about 25 per cent more than January 1. The iron and steel makers are producing less, the steel-rail makers less than ever and prices refuse to harden, notwithstanding the rather general refusal of makers to accept business at prices railroad builders are offering. Makers of machine-shop products have been quite busy all winter and railroads have been pretty well supplied with the resulting traffic westward to storage and distributing points throughout the Mississippi Valley. Agricultural implements are likely to be very generally wanted this season, at least manufacturers have for months been acting on this belief. Wood-working-machinery makers have not been overcrowded at all but fairly busy excepting some of the younger aspirants for trade. Builders of light locomotives for mine and lumber use have been quite busy, and all but about three locomotive-building concerns have had a full average labor force at work all winter.

There is a certain percentage of traders and manufacturers who are feeling the nipping effects of increasing competition, and, in their efforts to tide over temporary difficulties, a good deal of second-class "paper" has been made, which far-seeing and prudent bankers do not care to encourage. While there is a surplus above the legal limit in New York banks of from six to seven million dollars, there is a pronounced stringency among these traders, who are crowded towards the outer edge of the world's race-track. Times are not getting harder, but there are more business men in need of kind consideration from banks than three or six months ago, and it is not an easy matter to clearly explain why it is the case. Very few in trade or production are realizing as much margin. The strong point everywhere is that there is scarcely any accumulation of stocks. The copper trust is a magnificent exception, and the copper buyers on both sides of the water have their mouths set for a cheer if, and when, it terminates its existence. There is a greater necessity for caution in mercantile dealings now than heretofore for one or two reasons. Every producer is anxious to utilize his capacity or capital, or whatever he has to sell, and but little pressure is necessary to carry the present conservative management across the line into over-production. The possibility must always be kept in mind, in attempting to form opinions of trade probabilities, that a general and price-stimulating expansion of demand is always present, much as the statement may be doubted. Any posted financier or promoter will say to-day that if the projected work now before the country were entered upon, a boom in demand and prices would of necessity follow. But of this there is little present possibility. Railroad building will exceed the proportions anticipated by even well-informed editors of railway journals, as those know who keep a list of projected roads. There is no decline of manufacturing activity in the Southern States. Gold and silver mining enterprise is pushed. Last year, gold and silver production, according to mint figures, was $92,870 000. Large mining-machinery orders are drifting into foundries and mills where facilities are such as to do heavy work. The impulse that has been given to the mining of the precious metals by the profitable workings of new and old mines will not disappear, for railroad building in the far West is leading to a closer inspection of mineral territory, and the opening up of remarkably rich mines.

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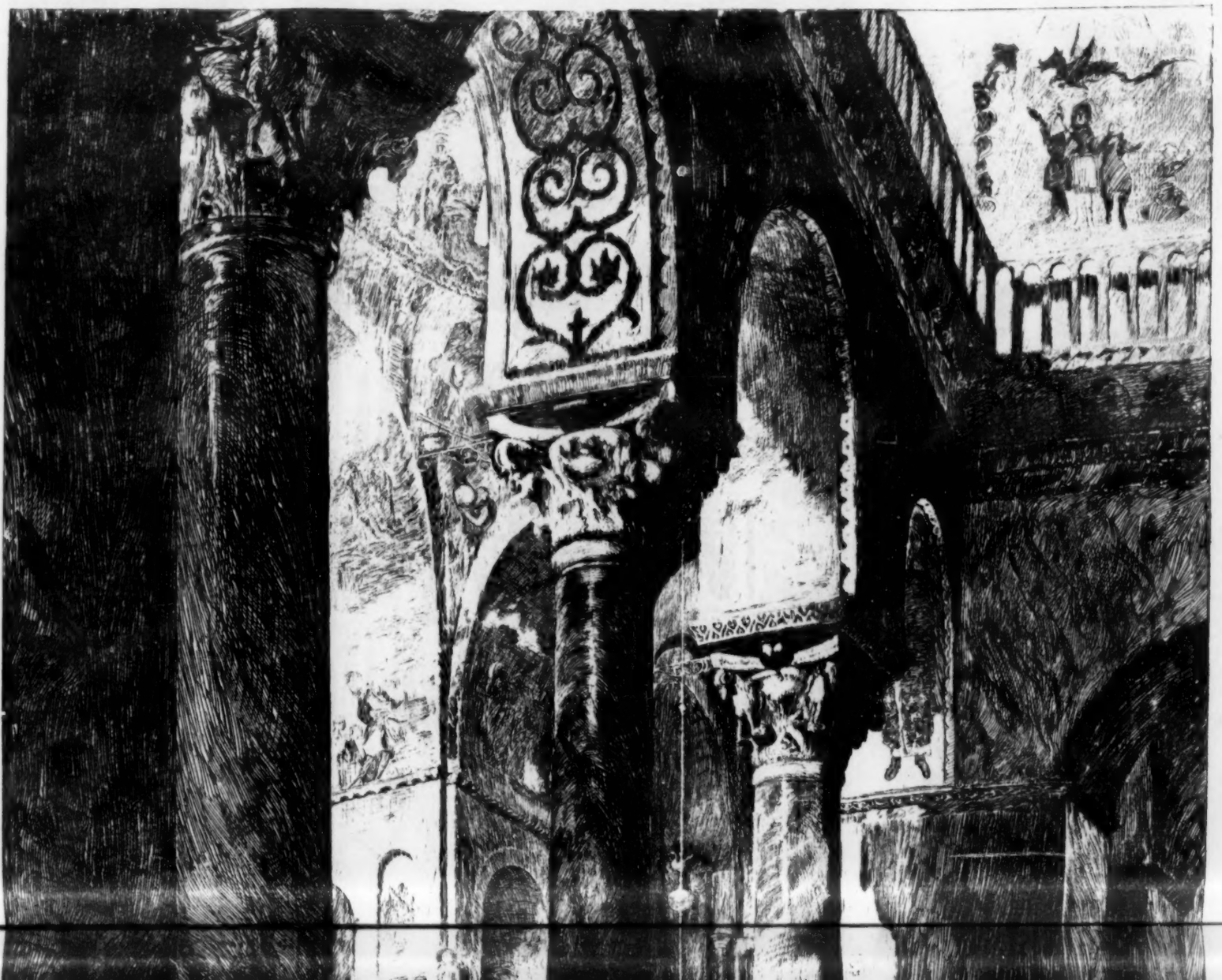

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BUILDING NEWS, MAR. 16 1889.